

## Description

Protection switching and monitoring method and arrangement in a data transmission system

The invention relates to a method for protection switching and monitoring in a data transmission system in accordance with claim 1 as well as to a suitable arrangement in accordance with claim 7

In data transmission systems protection circuits are provided to increase the transmission security. With 1+1 protection a data signal is transmitted to a receiving network element once over a working connection and a second time over a protection connection. If the working connection is interrupted the system switches over on the receive side to the protection signal transmitted via the protection connection.

In synchronous data transmission systems multiplex signals with very high data rates are frequently transmitted. Thus, in a typical „Synchronous Digital Hierarchy" SDH system described here a multiplex signal is transmitted as a rule containing at least one data signal referred to as a virtual container, but for higher data rates containing a number of virtual containers. Each of these VC-4 containers can in its turn contain a number of virtual containers of lower granularity (lower data rate). The virtual containers can in addition be transmitted over other signal paths as well, which further increases the reliability of the transmission network.

Protection switching can be undertaken between the complete multiplex signals, the working and the protection multiplex signal. With path protection the switching is between working path signals and protection path signals. A path signal here is taken to mean a data signal designated as a virtual

container which is transmitted as part of the multiplex signal from one subscriber to another subscriber.

The performance of the connection is constantly checked at both multiplex signal level and path level. Alarm messages are also generated for these connections. Accordingly separate cascaded protection switching devices are provided at multiplex level and at path level.

US patent 6,430,201 shows in Figure 3 a transmit arrangement which is described in column 5, lines 43-64. The active signals are selected in each case by a multiplexer 38. The receive side is shown in Figure 4. The problem of implementing multiplex signal protection and path protection is not addressed here.

The object of the invention is to specify an advantageous method for protection switching and for monitoring. In addition a suitable arrangement for said protection switching and monitoring is to be specified.

The object is achieved in accordance with a method for two monitoring methods specified in independent claims 1 and 5. Suitable arrangements for its implementation are specified in claims 7 and 8.

Advantageous developments of the invention are described in the dependent claims.

The particular advantage of the invention lies in the implementation of the protection switching functions at the multiplex signal level and the path level with only a single switching device.

In the invention one monitoring device is assigned to each

working path signal and each protection path signal. The monitoring values determined can be transmitted at low data rates.

The performance monitoring and alarm monitoring facilities which now lie before the switching device are embodied so that, as regards their function, they essentially correspond to those supervision devices arranged after the switching devices in conventional systems.

## Claims

1. Method for protection switching and monitoring in a data transmission system, in which a working multiplex signal (STM- $N_w$ ) is transmitted over a working connection (WV) and a protection multiplex signal (STM- $N_p$ ) over a protection connection (PV) between network elements (NE1, NE2) and on the receive side multiplex signal protection switching between these multiplex signals (STM- $N_w$ , STM- $N_p$ ) and/or a path protection switching between path signals (VC-4W1 - VC-4WN; VC-4P1 - VC-4PN) is undertaken as well as performance monitoring of the selected path signals, characterized in that,

the working multiplex signal (STM- $N_w$ ) is divided up into working path signals (VC-4W1 - VC-4WN) and the protection multiplex signal (STM- $N_p$ ) into protection path signals (VC-4P1 - VC-4PN),

the working path signals (VC-4W1 - VC-4WN) and the protection path signals (VC-4P1 - VC-4PN) are routed to only one switching device (11) both for multiplex signal protection switching as also for path protection switching, the multiplex signal protection switching is undertaken by switching all path signals (VC-4W1 - VC-4WN; VC-4P1 - VC-4PN), the performance monitoring of the working path signals (VC-4W1) and of the protection path signals (VC-4P1) is undertaken before the switching device (11) and performance values (FW, FP) of the working path signals (VC-4W1) or of the associated protection path signals (VC-4P1) in each case are accumulated and at the end ( $t_3$ ) of a monitoring period a resulting performance value (PW) is determined.

2. Method in accordance with claim 1, characterized in that

performance monitoring is undertaken for a working path signal (VC-4W1) in a working performance monitoring device (8) and for the corresponding protection path signal (VC-4P1) in a separate protection performance monitoring device (9).

3. Method in accordance with claim 1 or 2, characterized in that a number of protection connections (PV, PPV) are checked.

4. Method in accordance with claim 1 or 2, characterized in that only specific parts of the multiplex signals (STM-N<sub>w</sub>, STM-N<sub>p</sub>) or of the path signals (VC-4W, VC-4P) of lower granularity are checked.

5. Method in accordance with claim 1, characterized in that alarm monitoring (f3, f4) of the working path signals (VC-4W1) and the associated protection path signals (VC-4P1) is undertaken before the switching device (11) and the alarm criteria (ASW, ASP) of the signal selected in each case (VC-4W1 or VC-4P1) are passed on.

6. Method in accordance with claim 5, characterized in that after protection switching the alarm-criterion (ASW, ASP) of the newly selected working path signal (VC-4W1) or protection path signal (VC-4P1) is only changed after a checking time has elapsed.

7. Arrangement for protection switching and monitoring in a data transmission system, in which a working multiplex signal (STM-N<sub>w</sub>) is transmitted over a working-connection (WV) and/or a protection multiplex signal (STM-N<sub>p</sub>) over a protection connection (PV) between network elements (NE1, NE2) and on the

receive side a protection circuit between these multiplex signals or path signals (VC-4W1 - VC-4WN; VC-4P1 - VC-4PN) contained within them as well as performance monitoring of the selected path signals is undertaken.

characterized in that

only one switching device (11) is provided to which the working path signals (VC-4W1 - VC-4WN) are routed over working path lines (WL1 - WL4) and the protection path signals (VC-4P1 - VC-4PN) over protection path lines (PL1 - PL4), with the multiplex signal protection switching being undertaken by switching all path signals (VC-4W1 - VC-4WN; VC-4P1 - VC-4PN), a working performance monitoring device (8) is connected to each of the working path lines (WL1) and a protection performance device (9) is connected to each of the protection path lines (PL1) and.

an accumulation device (10) is connected to the alarm monitoring devices (8, 9) which determines the resulting performance values (PW).

8. Arrangement according to Claim 7,

characterized in that

a working alarm monitoring device (5) is connected to each of the working path lines (WL1) and a protection alarm monitoring device (6) is connected to each of the protection path lines (PL1). the working alarm signal (ASW) is routed from a working alarm monitoring device (5) and the protection alarm signal (ASP) from an associated protection alarm-monitoring device (6) is routed to an alarm switching device (7) in each case, the alarm switching device (7) is activated by an alarm control (4) to which a protection switching signal is routed (PSW) the alarm signal (ASW, ASP) of the newly-selected path signals (VC-4W1 or VC-4P1) is through connected via the alarm switching device (7) only after a checking time has elapsed.